**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_**

**Physical Science Guided Notes**

**Work, Power, & Machines**

***Work, Power, and Energy***

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_ exerted through a \_\_\_\_\_\_\_\_\_\_\_\_\_
    - * W:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**W**

* + - * F:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * d:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**d**

**F**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Problem: Brett’s backpack weighs 30 N. How much work is done when he lifts is 1.5 m from the floor to his back?
* Problem: A dancer lifts a 40 kg ballerina 1.4 m in the air and walks forward 2.2 m. How much work is done on the ballerina during and after the lift?
* \_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_at which \_\_\_\_\_\_\_\_ is done; how much work is done at at a given time.

**W**

* + - * W\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

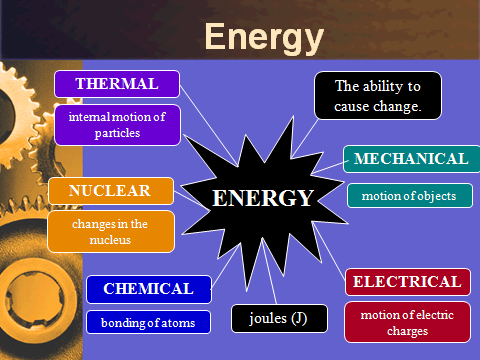
**t**

**P**

* + - * P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * t:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Problem: It takes 100 kJ of work to lift an elevator 18 m. If this is done in 20 s, what is the average power of the elevator during the process?



* \_\_\_\_\_\_\_\_\_\_\_\_\_Energy
  + Energy in the form of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Which has the most KE?
  + Which has the least KE?
    - * Kinetic energy depends more on \_\_\_\_\_\_\_\_ than \_\_\_\_\_\_\_\_\_
      * Problem: What is the kinetic energy of a 44 kg cheetah running at 31 m/s?
* \_\_\_\_\_\_\_\_\_\_\_\_\_ Energy
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_energy
  + Depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an object
  + Which boulder has a greater

gravitational PE?

* + What are other ways can an object

store energy?

* + - * + m=\_\_\_\_\_\_\_\_\_\_\_\_\_\_, g=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, h=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
        + On earth g=\_\_\_\_\_\_\_\_\_\_\_
* Problem: A 65 kg rock climber ascends a cliff. What is the climber’s gravitational potential energy at a point 35 m above the base of the cliff?
* Law of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Energy
  + Energy may \_\_\_\_\_\_\_\_\_\_\_\_\_, but it cannot be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ under ordinary conditions.
  + Ex:
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Machines***

* A device that makes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Changes the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Force

* **\_\_\_\_\_\_\_\_\_\_\_\_**Force (\_\_\_\_\_\_)
  + Force applied \_\_\_\_\_\_\_ the machine
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Force (\_\_\_\_\_)
  + Force applied \_\_\_\_\_ the machine

Work

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Work done \_\_\_\_\_\_\_ on a machine
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Work done \_\_\_\_\_\_\_\_\_ a machine
* Conservation of Energy
  + Can \_\_\_\_\_\_\_\_\_\_\_\_ get more work out

than you put in

* + Trade-off between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* In an ideal machine,
* But in the real world, some energy is \_\_\_\_\_\_\_\_\_\_\_\_\_ as \_\_\_\_\_\_\_\_\_\_\_\_\_

Mechanical Advantage (\_\_\_\_\_)

* \_\_\_\_\_\_\_\_\_ of times a machine \_\_\_\_\_\_\_\_\_\_\_\_ the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

MA >1 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

MA <1 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

MA =1 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fr=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fe=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Problem: A worker applies an effort force of 20 N to open a window with a resistance force of 500 N. What is the crowbar’s MA?
* Find the effort force needed to lift a 2000 N rock using a jack with a mechanical advantage of 10.
* If you do NOT have forces given, you can solve using distance

De=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dr=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Example: Using a block and tackle pulley, a boy pulls a rope 10 m to move up a weight 2 m. Find the MA
* Efficiency (HONORS ONLY)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Many lose efficiency due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + If a machine is \_\_\_\_\_\_\_\_\_efficient, it means it loses \_\_\_\_\_\_\_\_\_ of the energy to another form
  + Formula:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is always \_\_\_\_\_\_\_\_\_ than the \_\_\_\_\_\_\_\_ work

**Simple Machines**

6 types

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Levers*

* \_\_\_\_\_\_\_\_\_: A \_\_\_\_\_\_ that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ about a \_\_\_\_\_\_\_\_\_\_\_\_\_ point, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_machine

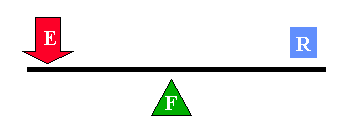


* + \_\_\_\_\_\_\_\_\_ must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_ than \_\_\_\_\_\_ in order to \_\_\_\_\_\_\_\_\_\_\_ the force

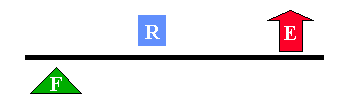
1. You use a 160 cm plank to lift a large rock. If the rock is 20 cm from the fulcrum, what is the plank’s IMA?
2. You need to lift a 150 N box using only 15 N of force. How long does the lever need to be if the resistance arm 0.3 m?

*Classes of Levers*

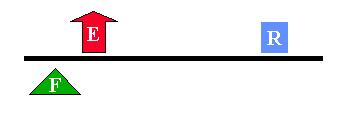
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the middle
  + Can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Changes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ex: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

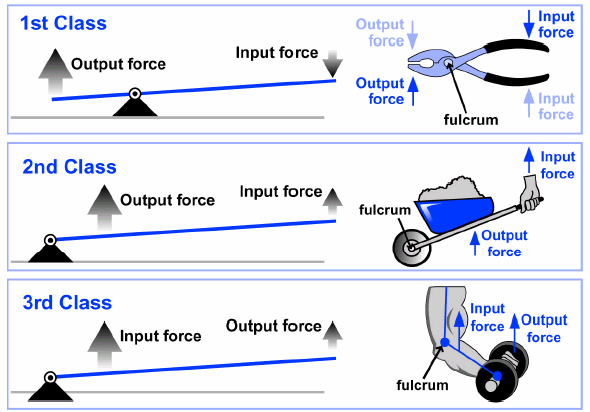


* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the middle
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ex: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



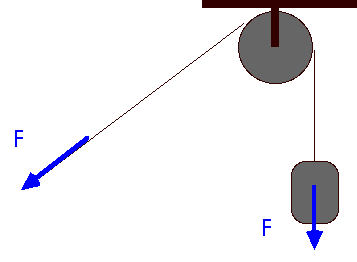
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the middle
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ex: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

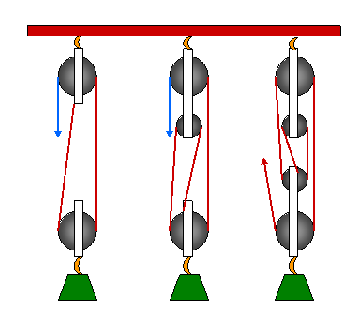


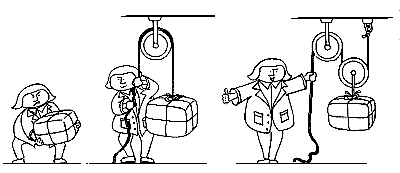


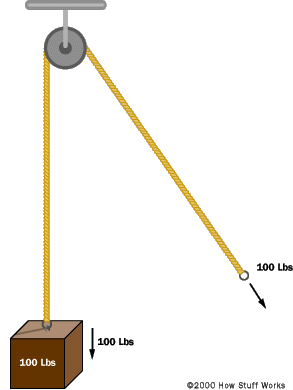
*Pulleys:*

* \_\_\_\_\_\_\_\_\_\_: a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* A “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”



* Ideal Mechanical Advantage
  + Equal to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Only count the end rope if pointing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

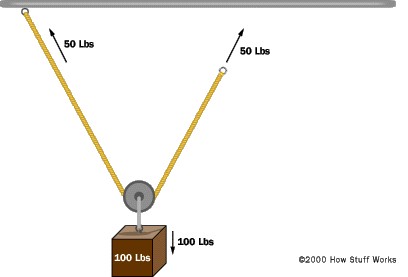


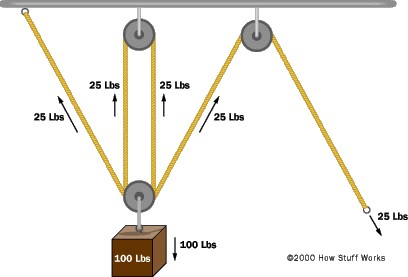


* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + IMA=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Does \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

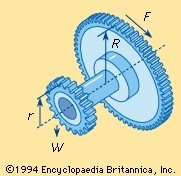
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + Changes direction of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

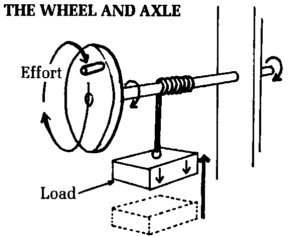


* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + IMA=\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Combination of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pulleys
  + Increases \_\_\_\_\_\_\_\_\_\_\_(IMA=\_\_\_\_\_\_\_\_)
  + May or may not change \_\_\_\_\_\_\_\_\_\_\_\_\_

*Wheel and Axle*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* A pair of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is usually applied to \_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_ moves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

But with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



*Example Problems*

1. A crank on a pasta maker has radius of 20 cm. The turning shaft has a radius of 5 cm. What is the IMA of this wheel and axle?
2. A steering wheel requires a mechanical advantage of 6. What radius does the wheel need to have if the steering column has radius of 4 cm?

*Inclined Plane*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

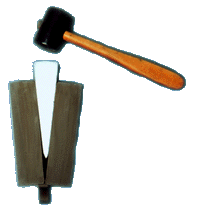
*Screw*

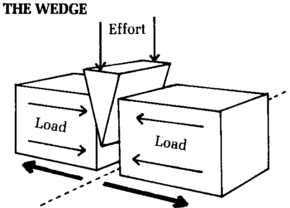
* \_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



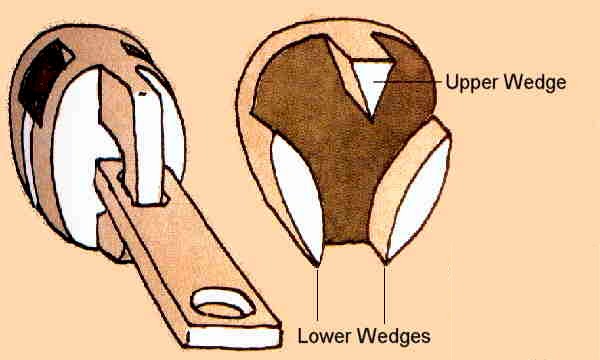
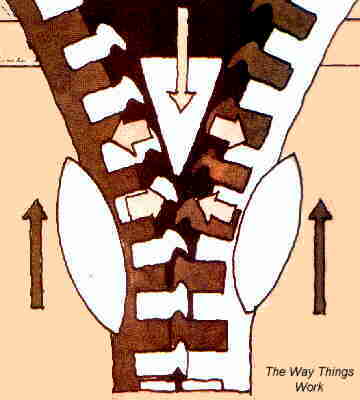
*Wedge*

* \_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_





* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Problem: How much force must be exerted to push a450 N box up a ramp that is 3 m long and 1.2 m high?

**\_\_\_\_\_\_\_\_\_\_\_\_Machines:** a machine made up of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Ex: scissors, car, bicycle, wheelbarrow